the meteorology and magnetism of the earth, and if so, does an increase of spotted area denote an increase of solar activity, or the reverse?

This question, I have already remarked, seems to be rapidly emerging from the realms of mere conjecture. But there is still another question, for we have to inquire whether these recognised solar inequalities bear all or any of the marks of a true periodicity. Now this is still *sub judice*, while at the same time it is a point of very great practical importance. For if the solar inequalities be found on investigation to present none of the marks of a true periodicity, we can hardly hope ever to be able to hazard a prediction regarding the state of the sun, and our knowledge of the eleven-yearly period, as it is called, will continue to remain very much the same as at present. But on the other hand, if we find that there are true solar periods and succeed in disentangling them, we may hope to arrive at some measure of predicting power. As I have said, this question is still unsettled, and will of course present itself in different ways to different observers. Meanwhile all we can do is to observe and register the actual state of the sun's surface, and inasmuch as the meteorological occurrences of greatest practical issue do not precede but follow solar phenomena by several months or more, we may thus arrive at a limited amount of practical prevision.

I do not however feel sure that the method of doing this which Mr. Chambers has indicated is in reality the best, for I should imagine that unexceptionable observations of the sun's intrinsic heat-giving power, if these could be obtained, would furnish a more trustworthy instrument of prevision than the sun-spot record.

Then with regard to indirect observations. No doubt those of the barometer are very immediately connected with the occurrences which we wish to foresee, but yet I think it possible that well-selected magnetic observations might ultimately be found to follow more quickly upon solar changes as well as to indicate with a less amount of local influence the true state of the sun.

These however are points that can only be settled by future research. Meanwhile it is extremely gratifying to all who take an interest in this subject to reflect that it is engrossing the attention of observers in all parts of the world.

BALFOUR STEWART

LIFE OF LIVINGSTONE

The Personal Life of David Livingstone, LL.D., D.C.L. Chiefly from his Unpublished Journals and Correspondence in the Possession of his Family. By William Garden Blaikie, D.D., LL.D., New College, Edinburgh. Portrait and Map. (London: Murray, 1880.)

WHEN the news of Livingstone's sad death on the swampy shore of Lake Bangweolo reached this country, and when his body was brought home by his faithful followers to be honoured as the nation honours its greatest and best; and again on the publication of his "Last Journals," we spoke in some detail of the great work he accomplished, and expressed our opinion as to the position which that work had earned for him. The years that have elapsed since Livingstone died at his post have only confirmed the judgment of the nation; and now that Dr. Blaikie's admirably-compiled "Personal Life" enables us to fill up the portrait, it will be seen that the man was as great as his work. Necessarily the missionary and religious side of Livingstone's character and work occupies a large place in this volume; this was to be expected from a writer who is a prominent leader in the Free Church of Scotland. But we do not think there is any excess in this direction; these were genuine and ever-present aspects of the character of the man, and Dr. Blaikie does not give them place at the expense of any other feature. He has honestly endeavoured to give us a complete portrait of his hero, and in this we think he has decidedly succeeded. Simplicity and transparency were marked features in Livingstone's character from first to last; delight in simple joys, a boyish love of fun, tenderness of heart and all-embracing charity, strong natural affection, the yearnings of which he could and did sacrifice to his still stronger sense of duty, the whole dominated by an all-conquering determination and perseverance in accomplishing the work which he believed was "given him to do." This is the impression which Dr. Blaikie's "Personal Life" gives, and in this it only confirms the impression which is conveyed by a study of Livingstone's own narratives.

Dr. Blaikie, however, tells us many things which must be new to most of those who knew Livingstone only through his works. We learn here how well qualified he was for the work which from early years he seems to have set before himself. Livingstone came of a good stock, which, though humble, knew of and had some pride in its ancestry. One ancestor fought at Culloden on the side of Prince Charlie, for on the mother's side he had some Highland blood in his veins. But the impulsive and sad temperament of the Celt was considerably modified by the practical and hopeful features of the Teutonic blood of his father. The latter was a type of the devout, rigidly honest, intelligent, and comparatively well-read, humble Scotchman, while the mother held the love and respect of her son to the end of her life. The family were poor, and all had to work hard; and early in life young Livingstone had to begin to earn his living in a cotton-mill at Blantyre, near Glasgow, where he was born March 19, 1813. With his first wages he bought a copy of Ruddiman's "Latin Rudiments," and thus early, it is evident, his aspirations went beyond the cotton-mill. His hours were long, but while attending to his "jenny," and till late at night, after his day's work was over, he conned his Ruddiman and other books to qualify himself for a University course. His thirst for reading was great, and he devoured all the books that came within his reach. Natural science also had its attractions for him, which he indulged by scouring the country when he had time in search of natural history specimens. Dr. Blaikie tells of Livingstone's "conversion" when he was a young man. This, in his case, means that what was instinctive action became thenceforth settled and conscious purpose. It was doubtless a proud day both for father and son when the former walked with the latter to Glasgow to see him settled in a humble lodging in order that he might attend the classes at Anderson's College. Livingstone never intended to be a clerical missionary; medicine was the subject of his study in Glasgow, and it was as a medical missionary he intended to accomplish the work of his life. It was only to please his friends and the

London Missionary Society he consented to "ordination." Chemistry seems to have been a favourite subject with him at college, and Dr. Blaikie narrates an interesting incident in which Livingstone and James and William (now Sir William) Thomson and Lyon Playfair met together at James Young's (now of Kelly) rooms, to witness some chemical experiment. Having been accepted by the London Missionary Society, Livingstone went to London to complete his medical studies, get some lessons in theology, and learn to preach. His failure in the latter accomplishment nearly led to his final rejection, and no doubt determined the Society to send him to the rough and humble field of Africa, instead of to China, on which his heart was set. The decision must be regarded as in every respect fortunate, though Livingstone had been some time in Africa ere he got over his disappointment. He went out to his work in Africa in 1841, and how anxious he was in every way to qualify himself for that work is shown by the fact that he got the captain of the ship in which he sailed to teach him the use of the quadrant and how to take lunars. With a few more lessons in taking observations from Sir Thomas Maclear at the Cape, he became an adept in this kind of work, and Sir Thomas afterwards expressed his astonishment at the almost perfect accuracy of Livingstone's observations in this department. He left the Cape as soon as he could and made for Moffat's station at Kuruman. Still further north he went, about 250 miles, and settled for some time among the Bechuanas, over whom, as over all other natives with whom he came into contact, he soon acquired great power and influence. His idea of a missionary's work was very practical, and rapidly developed and expanded, after he set foot in Africa. From the first he gave attention to geography, and his early letters are full of geographical details, illustrated by little sketch maps. How early his mind was attracted by the scientific questions connected with the geography of Africa will be seen from the following passage from the work before us:—

> "The progress of medical and scientific work during this period is noted in a letter to Dr. Risdon Bennett, dated 30th June, 1843. In addition to full details of the missionary work, this letter enters largely into the state of disease in South Africa, and records some interesting cases, medical and surgical. Still more interesting, perhaps, is the evidence it affords of the place in Livingstone's attention which began to be occupied by three great subjects of which we shall hear much anon—Fever, Tsetse, and 'the Lake.' Fever he considered the greatest barrier to the evangelisation of Africa. Tsetse, an insect like a common fly, destroyed horses and oxen, so that many traders lost literally every ox in their team. As for the Lake, it lay somewhat beyond the outskirts of his new district, and was reported terrible for fever. He heard that Mr. Moffat intended to visit it, but he was somewhat alarmed lest his friend should suffer. It was not Moffat but Livingstone, however, that first braved the risks of that fever swamp.
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> "A subject of special scientific interest to the missionary during this period was—the desiccation of Africa. On this topic he addressed a long letter to Dr. Buckland in 1843, of which, considerably to his regret, no public notice appears to have been taken, and perhaps the letter never reached him. The substance of this paper may, however, be gathered from a communication subsequently made to the Royal Geographical Society (see *Journal*, vol. xxvii. p. 356) after his first impression had been confirmed by enlarged observation and discovery. Around and north of Kuruman, he had found many indications of a much larger supply of water in a former age. He ascribed the desiccation to the gradual elevation of the western part of the country. He found traces of a very large ancient river which flowed nearly north and south to a large lake, including the bed of the present Orange River; in fact he believed that the whole country south of Lake 'Ngami presented in ancient times very much the same appearance as the basin north of that lake does now, and that the southern lake disappeared when a fissure was made in the ridge through which the Orange River now proceeds to the sea. He could even indicate the spot where the river and the lake met, for some hills there had caused an eddy in which was found a mound of calcareous tufa and travertine, full of fossil bones. These fossils he was most eager to examine, in order to determine the time of the change; but on his first visit he had no time, and when he returned he was suddenly called away to visit a missionary's child, a hundred miles off. It happened that he was never in the same locality again, and had therefore no opportunity to complete his investigation."

It was not likely that a man whose mind was filled with such problems would be content to settle down to the dull routine of the work of a common missionary, and count his success by the tale of doubtful "conversions" he could send home to his constituents. He kept moving onward from one station to another, getting further and further into the interior, gaining the love of the natives and the hatred of the Boers. By his example more than by direct teaching he showed the people the beauty of right living, and taught them many industrial arts which some of them have not lost till this day. But his longing was ever northwards, and his eager desire to solve the mystery of Lake 'Ngami. It was not till 1849 however that he was able to visit the lake, and his account of the visit first brought him permanently into notice as a working geographer. This may be said to have ended the first stage of Livingstone's career, that in which the missionary was predominant. It seems to us, however, doubtful whether Livingstone ever intended definitely to settle down to the life of a missionary. Even from the beginning, we think, he must have had some vague idea of combining the function of missionary and explorer, always, however, with the one great object in view of bringing Africa under the influences of civilisation and Christianity. Shortly after the 'Ngami excursion he became a missionary at large. Returning to Cape Town, he sent home his wife and children, and prepared himself for the great work of exploring the Zambesi. Proceeding northwards to Linyanti in 1852, he set out on that ever memorable journey to Loanda and across the continent to Quilimane, which stamped him as one of the greatest explorers of all time. The story of this and of his subsequent work in the region of Lake Nyassa, and of his many years' wandering all over Central Africa, he has told himself, and Dr. Blaikie wisely refrains from introducing more of it than is really necessary to hold together the narrative of his Personal Life. All that Livingstone has done for Africa it is not easy to estimate. It is he more than any other explorer who has filled up the great white blank in the maps of our schoolboy days. His geographical instinct was surer than that of any other man; only once was it seemingly at fault, when he wandered away by Lake

Bangweolo seeking for the "fountains of the Nile"; and that one mistake cost him his life. Men like Sir Thomas Maclear, Prof. Owen, and Sir Roderick Murchison testify to the high value of his observations in various departments of science; and it is due to his example and initiative that Africa is now covered with an army of explorers. Livingstone was a man who was consumed with a definite and noble purpose, which he firmly believed it was his duty to carry out unto death. In doing so he was bound to give offence, and he did make enemies: and so must every man who is able to conceive a great purpose and possesses strength of will and energy of physique sufficient to carry it out. Had he been weakling enough to be swayed by the scruples of others he would never have left Cape Town. No great work was ever yet accomplished without sacrifice; and we have here mainly to do with the work which Livingstone accomplished for science. That work is the highest of its kind, and had Livingstone been either a Byron or a Napoleon in character, the value of that work would not have been less. Fortunately it is clear from Dr. Blaikie's pages—which consist largely of Livingstone's own journals and letters—what indeed was pretty clear before, that Livingstone was a pure and tender-hearted man, full of humanity and sympathy, simple-minded as a child, with a healthy ambition to do a great work for Africa and for science, and with energy and courage sufficient to carry it out. The motto of his life was the advice he gave to some children he addressed in a humble Scotch meeting-house when he returned from his first great journey and found himself a great man—"Fear God and work hard."

SALVADORI'S ORNITHOLOGY OF NEW GUINEA

Ornitologia della Papuasia e delle Molucche di Tommaso Salvadori. Parte prima. 1 vol. 4to. 540 pp. (Torino, 1880.)

IN the second volume of the Linnean Society's *Journal of Proceedings*, published in 1858, will be found an article by Mr. Sclater on the Birds of New Guinea, which gives in a few pages a summary of the then existing state of our acquaintance with this subject. The bulky quarto now before us, to be followed by three or four other similar volumes, is no bad evidence of the vast mass of additions that has been made to our knowledge of the Papuan avifauna since that period.

In 1857 the only modern authorities on the birds of New Guinea were the naturalists of the French circumnavigating expeditions, who had explored the vicinity of Havre Dorey in the northern peninsula of the island, and the collectors for the Leyden Museum, who had visited Lobo Bay and other points on the south coast. Although much is still wanting to complete our knowledge of the Papuan avifauna, much has been done since those days. In 1858 our famous countryman Mr. Wallace passed some months at Havre Dorey, and made excellent collections in every branch of zoology. Moreover in the neighbouring island of Batchian Mr. Wallace was fortunate enough to come across a new form of paradise bird—one of the few recent additions to this remarkable group—which was deservedly named after its discoverer, *Semioptera wallacii.* Mr. Wallace was also the first of modern explorers to visit the Arroo Islands—which belong strictly to the same fauna as New Guinea, and in his well-known work on his "Travels in the Malay Archipelago" has given us a most interesting account of the habits of the paradise birds as there observed, and of the manner in which the natives procure their specimens.

After Mr. Wallace the Italian travellers D'Albertis and Beccari were the next to visit New Guinea, and succeeded in carrying their investigations further into the unknown interior than it had been hitherto believed possible to penetrate. The ascent of the Arfak Mountains was first accomplished by D'Albertis in 1872, and Beccari succeeded in making the same dangerous journey some years later, besides visiting many localities on the north coast which had not been previously explored. Both these naturalists were active collectors of birds, and transmitted large collections to Europe. In 1875 and the following year D'Albertis turned his attention to the southern portion of New Guinea, and during his excursions up the Fly River made fresh additions to our knowledge of Papuan ornithology. In the meantime a German naturalist, Dr. A. B. Meyer of Dresden, was engaged on new explorations on the shores of the great Bay of Geelvinck, and did not fail to make considerable additions to the rich avifauna of that district.

While Prof. Salvadori has not neglected to consult every existing authority on Papuan ornithology, and, we believe, to visit every European museum which contains specimens from the Papuan region, it is mainly upon the large series accumulated by his countrymen D'Albertis and Beccari, to which must be added the numerous specimens obtained by the hunters of Heer A. A. Bruijn of Ternate, that his present labour is based. These collections, or at any rate all the important portions of them, have passed into the Museo Civico of Genoa, either through the liberality of the Marquis G. Doria, the founder of that institution, or through assistance given by the Italian Government. Their extent may be judged of from the fact, stated in the preface to the present volume, that they contained no less than 9539 specimens, which have thus come directly under Prof. Salvadori's observation, besides the examples examined in the Museums of Paris, London, Leyden, Bremen, Berlin, Dresden, and Vienna, which, as already stated, our author has visited for the purpose of preparing his work. It is evident therefore that materials did not lack, and Prof. Salvadori's well-known abilities as an ornithologist give us every confidence that these materials will have been well used.

Such indeed is doubtless the fact. If the succeeding volumes of the "Ornitologia della Papuasia" shall be executed in the same style as that in which the first volume has been prepared, there can be no question that a most important work will have been accomplished. Not only is every species fully and accurately described, but its complete synonymy is given, a detailed list of the specimens from various localities and remarks on their differences are added, and, in fine, every necessary particular is given that can contribute to a perfect history of the species. Would that other geographical works on ornithology were carried out with equal exactness and similar strict attention to details!

In conclusion we have only to express our thanks to